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New Record of Exotic Fish Red Bellied Pacu, *Piaractus Brachypomus* (Cuvier, 1818) From Vellayani Fresh Waterlake, Southwest Coast Of India

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Abstract: ***This paper documents the first record of the occurrence of the exotic South American fish Red Bellied Pacu related to the piranhas, in Vellayani Freshwater Lake at Thiruvananthapuram district, Kerala, the southern part of Western Ghats region. The morphological taxonomy revealed that the specimen is Piaractus brachypomus (Machado-Allison 1982; Goulding and Carvalho 1982; Ruiz-Carus and Davis 2003) of the subfamily Serrasalmidae (Pacus and Piranhas) of family Characidae. The preliminary investigation revealed that Pacu, one of the preferred aquarium fishes, might have reached the lake accidently and established a viable population. Though not fierce and deadly like piranhas, the adult pacus being omnivores feeding on fishes, it rings alarm bells of danger to the 42 species of already existing fish populations (Bijukumar et. al, 2013) in Vellayani Lake, the second largest fresh water lake in Kerala.***

Keywords: Red bellied pacu, Characidae, Serrasalmidae, *Piaractus brachypomus*, Vellayani Freshwater Lake

1. Introduction

There are so many reports of introduction of exotic species causing numerous negative effects to biodiversity, natural environment, economy and even human health. Often the exotic species become predators or competitors of native species (Hill AM, DM Lodge, 1999). The ornamental fish trade spread all over the world has already become a route to exotic fish introduction to indigenous natural habitats, and it is reported that one third of the world‟s worst aquatic invasive species are ornamental fishes (Padilla and Williams, 2004). Red Bellied Pacu is an appreciated food fish which led the Brazilian Government to set up a breeding programme for the species to replenish the wild population. The project was successful and this has led to Red Bellied Pacu becoming the absolutely most common Pacu in the aquarium trade.

Introductions of Red Bellied Pacu populations have been reported in many regions around the globe, in places as unlikely as Vancouver, British Columbia, etc. This South American native fish was found near Yuma, Arizona in June 2006 and in New Jersy in June 2015 (Brian Clark Howard, 2012). Zeb Hogan of University of Nevada, Reno (2007) has reported the occurrence of pacu in Denmark, Michigan and other places and opined that these fishes are not dangerous to humans. However, there is a report from Papua New Guinea in 2011, of two human deaths due to Pacu attack by biting off the testicles of fishermen (Rick Spilman, 2013).

Red Bellied Pacus were introduced to India sometime between 2003 and 2004 from Bangladesh and have become the focus of several aquaculture projects. (Innes, 1966; Hanke, et al., 2006; Ramirez-Duarte, et al., 2008; Chattarje and Mazumdar, 2009; Froese and Pauly, 2010; Nascimento, et al., 2010). In 2011, Unmesh Katwate et.al angled a huge pomfret like silvery fish from Gadhi River in Panvel, Maharashtra the northern Western Ghats region, which was later identified as Red Bellied Pacu, *Piaractus brachypomus.* From the main river channel eight more *P. brachypomus* were subsequently collected by the same team.

In Kerala, recently, this fish was recorded from Periyar River. Researchers from National Board of Fish Genetic Research, Kochi had identified the fish caught from natural waters of the Periyar and Chalakkudy Rivers as Pacu in 2011. Many bio-invasions have been recorded in Kerala, which is part of the Western Ghats biodiversity hot spot. The new competitors in the race for survival in the Western Ghats region are piranha‟s relatives. According to the ornamental fish vendors Pacu, Piranha and the related groups are supplied to the city aquaria from neighbouring states by the wholesalers. In Kerala, the local ornamental fish vendors also culture these fishes in ponds**.**

This paper documents the invasion of *P. Brachypomus* in the Vellayani Freshwater Lake in the valleys of Southern Western Ghats in Thiruvananthapuram district of Kerala, and the challenges faced by the biodiversity of the lake, especially the ichthyofauna.

2. Materials and Methods

2.1 Study Area and Sample Collection

The fish was collected from Vellayani Freshwater Lake (8° 24‟ 09”- 8° 26‟ 30” N and 76° 59‟ 08”- 76° 59‟ 47” E) Thiruvananthapuram Distrct in Kerala (Fig. 1), located 19 km away from Thiruvananthapuram city. The lake is situated 29 meters above mean sea level with a length of 3.15 km and width of 1km. The depth varies from 2 to 6 m.

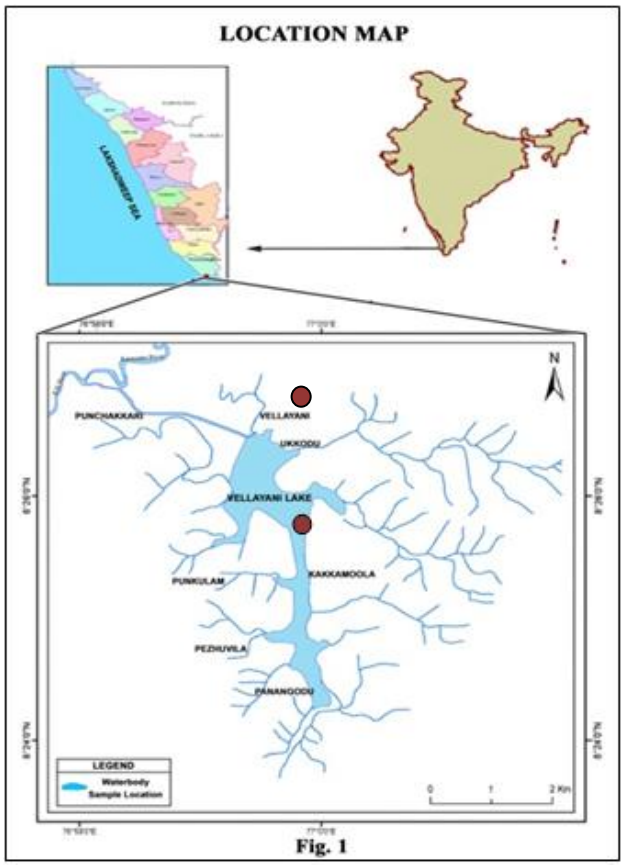

Figure 1: Red spot represents the region of the Lake from where Red Bellied Pacu was caught.

During a fish biodiversity survey of the Lake (June 2013 to May 2016), a Red Bellied Pacu was observed among the catch on 3-11-2015. „Pattu Vala", a type of seine net was used for the collection of the fish during night. The specimen was brought to the Laboratory for taxonomic identification. Previously published descriptions available from the internet were used to ascertain whether the fish was Pacu or Piranha. Further identification up to species level was carried out using the distinguishing characteristics provided by Machado-Allison, 1982; Goulding and Carvalho, 1982; Ruiz-Carus and Davis, 2003. The identified specimen is preserved at the Laboratory of Fatima Mata National College, Kollam, under the University of Kerala.

3. Results and Discussions

Red Bellied Piranha (Pygocentrus nattereri) is the world's most misunderstood fish with regard to identity. Red Bellied Pacus are often mistaken for piranhas. Pacus and Piranhas together form a family known as the Serrasalmidae, which in some references is still referred to as the subfamily Serrasalminae, under the family Characidae. Though Pacu is nearly identical to the fierce and deadly Piranha, it is a peaceful omnivore. These fishes have many similarities in both appearance and behavior.

The sample fish was confirmed as Red bellied Pacu and not Red Bellied Piranha, based on the following characters, as per the descriptions of Machado-Allison (1982) and Froese and Pauly (2010).

- Red Bellied Pacu can be distinguished from piranhas primarily by dentition. Single row of serrated incisor-like teeth is present in piranhas, but two rows of molariform teeth in Pacus (Fig.3 and4). In the sample specimen, there were two rows of hard, flattened teeth (the inner row is not completely developed, as the specimen was juvenile). This dentition is comprised of 2 series of molariform incisors located on the premaxilla and 1 row of dentary teeth.
- Piranha is smaller species reaching around six inches (about fifteen centimetres). Pacu are generally very large fish and are exceeding two feet (sixty centimetres). The sample fish obtained measured a standard length of 20 centimetres (more than 15 centemetres).
- As juveniles, Red Bellied Pacu mimics Piranha by displaying dark grey to black spots on the body, a standard characteristic of piranha. The sample specimen possesses the same spots, showing that it is a juvenile Pacu. According to Froese and Pauly (2010), as Pacu reaches adulthood, the spots disappear.

The sample specimen Red Bellied Pacu (Fig.2) was identified as *Piaractus brachypomus* (Cuvier 1818), native of the Amazon and Orinoco river basins in tropical South America as per the distinguishing characteristics provided by Goulding and Carvalho, 1982; Innes, 1966; Schleser, 1997; Ross, 2001; Sakamoto, et al., 2001; Ruiz-Carus and Davis, 2003; Lovera, 2005; Nascimento, et al., 2010. Red Bellied Pacus form a single genus *Piaractus*. There are two recognised species in the genus, namely *P. Brachipomus* and *P. Mesopotamicus*. The sample specimen was identified as *P. Brachipomus,* based on the following characters.

- Spotted body (juvenile)
- Fins are dark edged (juvenile)
- A distinctive large blotch on the opercle (Fig.2)
- Larger number of lateral scales compared to *P. Mesopotamicus* (<110) - 119
- The body is deep and laterally compressed, with silvery sides (becoming darker approaching the dorsum) and red coloration on the belly, chin, pectoral fins, and the leading rays of the anal fin. The remaining rayed fins are uniformly dark-coloured.
- A small, unrayed adipose fin is present approximately midway between the dorsal and caudal fins (Fig.2).
- The dorsal fin has 18 rays, the pectoral fins 16, the anal fin 27, and the pelvic fins 8. The first few rays of the dorsal and anal fins are longer than the remaining elements.
- A row of sharp serrae formed by modified scales is found on the abdomen.

4. Scientific Classification

Kingdom : Animalia
Phylum : Chordata
Class : Actinopterygii
Order : Characiformes
Family : Characidae
Subfamily : Serrasalmidae
Genus : *Piaractus*
Species : *P. brachypomus*
Binomial name : *Piaractus brachypomus* (Cuvier, 1818)

Synonyms : *Colossoma bidens* (Spix and Agassiz 1829), *C.brachypomum* (Cuvier 1818), *Myletes paco* Humboldt 1821.

Common name : Red Bellied Pacu, pirapatinga, cachama blanca.

Figure 2: Red- Bellied Pacu (***Piaractus brachypomus*** Cuvier, 1818) from Vellayani Fresh water Lake

Figure 3 **Figure 4**

Figure 3 and Figure 4: Molariform (human teeth-like) teeth in ***Piaractus brachypomus*** **(Cuvier, 1818)**

Common names for this species vary by region. It is known as „pirapitinga" in Brazil, „paco" in Peru and „cachama blanca" in Colombia (Innes, 1966; Hanke, et al., 2006; Ramirez-Duarte, et al., 2008; Chattarje and Mazumdar, 2009; Froese and Pauly, 2010; Nascimento, et al., 2010).

In aquarium, Pacus are omnivores and require a diet of both high protein and vegetable matter. Cichlid pellets and koi pellets are the common food items given by aquarists. To provide protein, fish, worms, and fish meat are also given. In the wild, Pacus eat a variety of foods. The main part of their diet consists of fruits, nuts and seeds. The teeth of Pacu are adapted for cracking open the hard shells of nuts and seeds. Despite being mostly vegetarian during the growth period, the adults will feed on smaller animals such as insects, smaller fish and even mammalian body parts, as pointed by gut content analysis of Red Bellied Pacu from the Sepik-Ramu River Basin, Papua New Guinea (Sandra Bibiana Correa et al., 2015). The stomach content analysis of Red Bellied Pacu revealed that the main food was plants or detritus matters and fruits as per the above mentioned study. They also feed on zooplankton, insects, snails and decaying plants. Due to the presence of powerful dentition they can crush hard food and cause serious bites (Arsenia G.2007).

Although Red Bellied Pacus are widely considered to be frugivores, they are actually omnivorous, also eating crustaceans and smaller fishes, especially in the dry season. As some of the largest fish in the Amazon, pacu require large amounts of food. They feed in multiple "bite events", with each event containing a number of individual bites, which is similar to the feeding behavior observed in true piranhas (Burkhart, et al., 2002; Fernandes, et al., 2004; Hanke, et al., 2006; Froese and Pauly, 2010).

Cumulative impacts of exotic fish species are resource competition and predation. The result of niche overlap is an ecological havoc, like species extinction. The study revealed that the presence of Pacu in the wild habitat of Vellayani Lake may be due to an accidental release of aquaculture stock. According to local fishermen there had been instances of the presence of these fishes in their catches earlier also, and they used them as food fishes, as riverine pomphret. Recent records of predatory Pacus and piranhas have set the alarm bells ringing for ecological havoc in the Western Ghats biodiversity hotspot (Katwate, et.al, 2012). Red Bellied Pacu is not an invasive fish under natural conditions. But they become invasive as they get released into the natural waters. According to Cagauan and Joshi (2002), the

large Pacu can be disadvantageous to the rice crop by damaging young rice plants, in Philippines. Being an aggressive aquatic plant eater, the fish may be advantageous as a biological control for aquatic weeds and golden apple snail (Cagauan, 2007). The molluscivorous feeding habit of Pacu may have a negative impact on the native edible and economically valuable snails such as *Corbicula manilensis*, *Pila conica*, *Thiara* sp. and *Vivipara* sp. in Philippines (Cagauan, 2007).

The proliferation of Pacu population in Vellayani Lake will definitely be a threat to the biodiversity of the lake, especially to the ichthyofauna (Mike FishLore, 2012; Lois, 2012; Robert Boumis, 2014), which will have far reaching effects on the livelihood of the local fisher folk.

5. Conclusion

The aquarists and game experts usually misidentify Pacus, especially of *Piractus* genus and the traders import them as vegetarian Piranha, misleading the public into thinking they are Piranhas, creating panic when seen in natural waters. Unlike Piranha, they grow larger in size and eventually become unsuitable for aquaria. This might be one of the reasons for their disposal into natural water bodies. Hence there should be mechanisms to inform the traders and aquarists regarding the correct identity and biology of exotic aquarium fishes.

The traders, aquarists and the general public must be made aware of the dangers of exotic species in indigenous natural ecosystems.

In Vellayani Lake, it seems that, a good number of Pacus might have gained entry from an overflowing pond, during rains, where they were cultured for aquarium purpose. If there is a viable population of *P. Brachipomus* in the lake (it has to be confirmed by further studies), it is a serious matter which should be addressed from a higher level of administration, as these fishes during their intense growth stage may consume the native fishes in large numbers.

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